Public Sector Enterprise Resource Planning[1]

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Summary

The management of the Department of Defense (DoD) enterprise must change. Since 1989, the DoD has "chronically under-funded its installations' base support services and facilities as evidenced by an increasing backlog of maintenance and a migration of funds from mission accounts to provide essential base support services." Years of under funding have led to a wide gap between enterprise support requirements and resources. This gap has been estimated to be a wide as $5 billion, just for DoD installations. This leaves few options:

- Make significant cuts in capabilities and infrastructures. This would close the gap, but unfortunately history has shown that it is easier to reduce capability than infrastructure.
- Add additional dollars to close the gap. While it is true that the politicians are already discussing possibilities for spending future budget surpluses, it is unlikely that this alternative would be realized.
- Make cuts in some items, but do some things smarter, so that effectiveness is maintained while cost is reduced.

Private sector firms have faced similar choices. As their market shares were evaporating, they selected the third option to help them regain competitive advantage. Their cost structures were bloated, so they used an approach that is similar to that described in this paper, to extract resources from their infrastructure. The intent was to

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focus the extracted dollars on designing, producing, and bringing to market better and price competitive products. The situation faced by many of our largest corporations in the late 1980s and early 1990s is similar to that currently faced by the DoD.

Routine organizational processes consume a large portion of the Defense Department's budget. These processes are devoted to organizing, planning, staffing, monitoring, and controlling all aspects of defense organizations and projects. Many of these processes are mundane (for example, payroll, human resources, etc.), with private sector characteristics. New management and technology solutions to enable routine processes have been implemented in the private sector with much success. There is interest in implementing such solutions in the public sector, but implementation is lagging the private sector. Part of this slowness is cultural resistance combined with the absence of market discipline, but part of the problem is a general lack of understanding of private sector options among government managers and their contractual advisors. Government processes are characterized as being special, and many are (for example, command and control processes), but there is nothing special about mundane infrastructure-oriented business processes. They are prime candidates for the management methods and systems that have enabled the restoration of competitive advantage in the U.S. private sector.

Much has been written about <u>why</u> the public enterprise must change, and much of that literature is referenced in this paper. We have little to add on this issue. The problems have been studied, and the conclusions are sound and can be replicated. The strength of this paper is that it shows <u>how</u> the public enterprise can be changed. This paper is based on five years of public/private sector research and implementation

experiences. We provide the details of how private sector firms are using IT-enabled process management to obtain competitive advantage, and we show how the same approach may be used on the public enterprise.

This is a complex undertaking, much too complex to explain in detail in a short summary. We highlight the features of the approach, using terminology that is defined in the paper. The paper focuses on a management model and a technology model. The management model requires planning, core process management, and performance measurement as required by existing legislation. The technology model aligns with the management model, creating what is known in the public sector as the Integrated Data Environment. That is, the organization manages by process, with all information systems aligned with the process. This provides a structure for allowing managers to meet their strategic objectives while complying with the law, and accomplishing this with information that actually supports the day-to-day management process.

Integrated system implementations in the private sector are based on generic and industry specific reference models. Pre-engineered and integrated *Standard Software Solutions*, based on best practice reference models, have been implemented worldwide in most of the largest corporations. These *Standard Software Solutions* avoid costly and high-maintenance proprietary developments that are common in public enterprises, while creating configuration management for data and processes across the enterprise. We are proposing that the DoD consider a similar approach for the public enterprise. As argued in the paper, we believe that this approach is very appropriate for a number of DoD domains; e.g., installation management, civilian personnel management, electronic procurement, etc. Hence, our hypothesis is that private sector implementations of

Standard Software will lead to increased effectiveness and efficiency in public sector organizations. In the US, these pre-engineered and integrated *Standard Software Solutions* are called Enterprise Resource Planning (ERP) systems. Our domain for arguing the assertions of this paper is the US Defense Department, since our research efforts have concentrated in this area.

We provide sufficient detail on how to transition to a modern integrated public sector enterprise, and we outline the steps for implementing such a project, following standard private sector implementation practices. To further explain the problem and solution, the DoD Installation Management enterprise is used as an example.

1. Introduction

The Department of Defense enterprise is large and complex. The largest business process is *Manage Defense Acquisition*, with *Manage Defense Installations* being second. However, the two processes are different in structure. For example, the execution of acquisition functions is unique, with no comparable private sector business process. Other business processes, including *Manage Defense Installations*, are not particularly unusual, with functions that have direct analogies to those in the private sector.

We assert that the DoD will eventually change the way that it manages the non-unique business processes. The declining resource base will not support the existing infrastructure, but even if resources were plentiful, there would still be strong incentives to change. New IT-enabled process management methodologies have been implemented worldwide, and organizations are achieving enhanced efficiency and effectiveness through the use of these new management approaches. We are seeing the first signs that

the new approaches are spreading to the public sector, and we expect (as usual) that the DoD will be an early implementer and a leader for other public organizations.

In fact, as will be discussed later in the paper, the public law already requires the management approach that is outlined in this paper. However, most public organizations are struggling with implementing the requirements of the law. Few, if any, have implemented management models and information systems that support the requirements of the law. Appropriate models and systems have been implemented in the private sector, and we argue throughout this paper that the DoD can learn from these private sector experiences. Private sector implementations have led to competitive advantage, better management control, and cost reductions. While the DoD incentives and performance measures are different than the private sector, better management control and cost reductions are certainly public sector objectives.

We describe in detail how private sector organizations are integrating their business processes, and we draw comparisons to the DoD experience. We describe a public sector management model that is consistent with private sector models, and we demonstrate how the model should be implemented. The discussion covers all aspects of the new private sector management paradigm, ranging from strategic planning to information system implementation. We provide details on the implementation steps, and make suggestions on selecting DoD and contractor teams for implementing a new way for managing the public enterprise.

This paper covers significant material in limited pages. It draws heavily on our personal experiences working for the US Department of Defense. However, it also draws on our experiences in working for private sector organizations, including interviews with

senior executives in some of the largest corporations in the world. This paper is firmly grounded in the modern management literature, and it describes an approach that has been proven in the private sector. We begin the discussion by making a case for why the DoD must consider a new approach for enterprise management, and then we move directly to the management and technology models.

2. Change is Inevitable

The following quote sets the stage for this section:

> The mission support and services provided to our forces at base level is an extensive business enterprise. This enterprise is on the path to a critical failure unless DoD rethinks installation management. Before we consider making changes at the margin, we need a new lens through which to view our bases (Milnes, 1997).

The consensus is that there is not a coordinated and integrated view of how to manage the DoD business processes, with installations being just one example.

We apply the ideas outlined by Milnes (1997) to the entire DoD enterprise. The following items are needed:

- A statement of the purpose for the DoD enterprise,
- A vision of how the future enterprise will look and what it will produce,
- A doctrine for how the enterprise should operate,
- A set of tools for getting the job done efficiently, and
- A plan for reaching the future state.

This paper provides one approach to addressing part of this challenge, but it is important to reiterate that we are only focusing on the business processes. The warfighting processes are unique, and they cannot be aligned with private sector business processes. Because of their special requirements, private sector approaches to enterprise integration are not directly transferable to the warfighting processes. The warfighting processes are not the subject of this paper.

Why is such a rethinking of the defense enterprise so critical at this time? Why not just refine and fine-tune the existing model? These questions are similar to those that were facing private sector enterprises in the late 1980s. In the case of private sector companies, their market shares were decreasing, and they were strapped with inefficient and bloated infrastructures that did not enhance competitive advantage, but required internal funding. The DoD faces a similar situation. Since 1989, the DoD has underfunded many of its support activities. The simple fact is that years of under-funding have led to a wide gap between support requirements and resources. This gap has been estimated to be a wide as $5 billion, just for the installation management process. This leaves few options:

- Make significant cuts in capabilities and infrastructures. This would close the gap, but unfortunately history has shown that it is easier to reduce capability than infrastructure.
- Add additional dollars to close the gap. While it is true that the politicians are already discussing possibilities for spending future budget surpluses, it is unlikely that this alternative would be realized.
- Make cuts in some items, but do some things smarter, so that effectiveness is maintained while cost is reduced.

These are the same alternatives that faced many private sector firms, and the third alternative was the path that was chosen. While all firms did not successfully make the transition, many were successful, and have obtained competitive advantage while reducing their size and focusing on their core competencies. The open question is the following: Will the DoD enterprise successfully make the transition? Will reductions sacrifice military capability?

3. DoD Managers Can Learn From Private Sector Experiences

It is clear that government is managed differently than the private sector. The performance measures and incentives are distinctly different. There are no public sector performance measurement equivalents for "profitability" and "return-on-investment," and public managers have a special obligation to wisely spend the taxpayers' dollars. However, there are many public sector processes that are equivalent to private sector business processes. These are mundane but necessary processes that are essential for sustaining the enterprise. What is the nature of these processes, and how are they managed? Again, we quote Milnes (1997):

> In all there are over 100 unique business functions that take place on installations to support installation commanders and their tenants. The nature of these base support business functions more closely parallels that of a large commercial enterprise. In the United States, this base support "business" consumes roughly $40 billion annually and manages assets (real estate and facilities) approaching $1 trillion at about 400 installations. Our U.S. installations provide facilities and service to about 1 million active military, around 2 million family members, nearly 800,000 civilian employees and 1 million military retirees. On average, each installation commander is in charge of an activity which services 2,500 active military, 5,000 family members, 2,000 civilian employees, and 2,500 retirees, has assets approaching $2.5 billion, and expends $100 million annually. To manage this business enterprise efficiently, we need a long-term perspective and investment strategy. Currently though, our installation management parallels our wartime management practices and structure, following established doctrine for near term engagements without seeing a need for establishing priorities for long term (multi-year) engagements.

Our assertion is the following. There is nothing special about the management of public organizations that preclude them from implementing modern private sector management practices and integrated information systems. The performance measures and incentives may be different, but the business processes are essentially the same as the private sector. The need for accurate and timely management information in the public sector is the same as in the private sector. If the processes are the same as the private sector, there is no reason that the information systems that support the processes should not be the same.

If the DoD does not learn from the private sector, how would change occur? The private sector has been experiencing this change for ten years. As will be argued in the next section, most of our largest enterprises have made the transition to integrated IT-enabled process management. For these companies, the increased effectiveness (i.e., competitive advantage) has been considerable. The corresponding cost reductions are also finally being documented. There is much that the public enterprise can learn from many of our large private sector enterprises. This paper focuses on smart and modern management methods, enabled by off-the-shelf technologies.

4. Management at the Millennium

Current DoD management of the mundane business processes is top-down and hierarchical, with many mid-management levels exerting considerable micromanagement from above. Some estimate that these non-value-added mid-level management process account for well over a third of the management activities. With respect to public enterprise management, the analogy shifts to large corporate models that were common in the post-WWII period. This model is the current approach to managing most public business processes.

As firms moved to new management models, they reduced their management bureaucracies. Figure 1 describes the nature of the reductions that occurred in most U.S. corporations in the late 1980s and early 1990s. Many U.S. organizations found that due to competitive pressures, growth in their customer-focused value-adding processes was stagnant. However the overhead and underhead (that is, non-value-added middle management) components continued to grow. The era of reengineering was focused on reducing overhead and underhead, while focusing reclaimed resources on core processes;

that is, those processes that add value to the customer (Earl, 1994). Figure 1, through the size of the boxes, reflects the pattern of overhead reduction that the modern organization hopes to achieve over time.

This simple model in Figure 1 was the impetus for most of the corporate reengineering activities of the early 1990s, and the model did not go unnoticed by the DoD. We have written extensively about how these corporate models had much less success in the DoD [see Gulledge, et al. (1995)], and consequently, the DoD is facing a management crisis in the late 1990s. The message was presented by Admiral William Owens (Ret.), the former Vice Chairman of the Joint Chiefs of Staff at a recent meeting at the Brookings Institution (Owens, 1997). The obverse of Figure 1 captures the essence of the management problem within the DoD. The core is stagnant, and the overhead and underhead burden from higher management levels continues to grow.

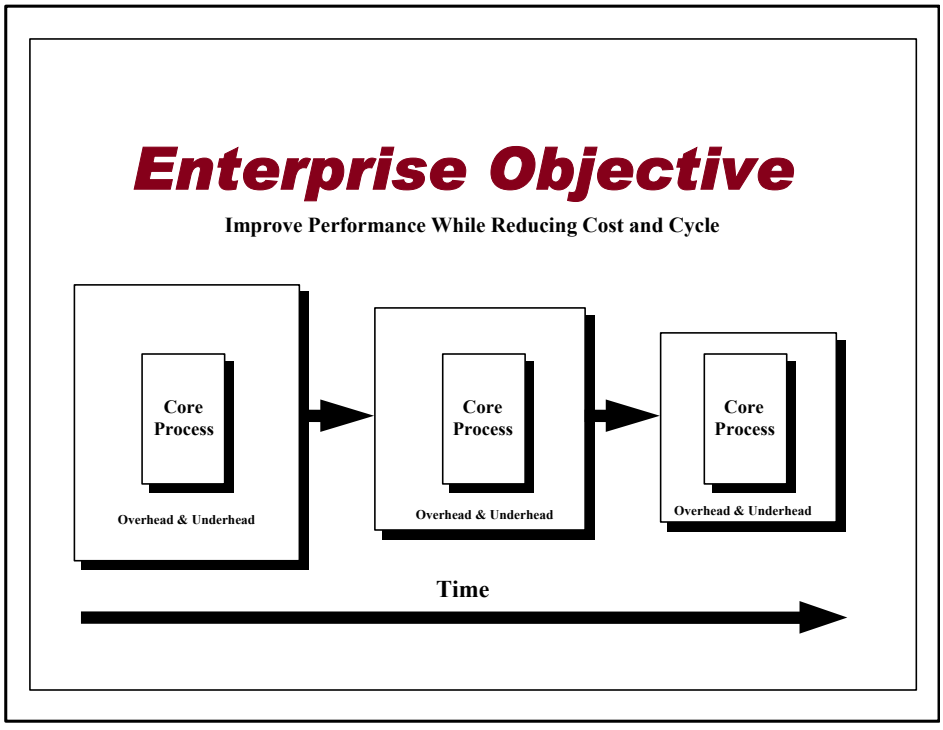

Figure 1 - Reduction of Overhead and Underhead as an Enterprise Objective

4. The Management Model: Why IT- Enabled Process Management?

Process management is as old as the discipline of Industrial Engineering. Localized implementations of process management (e.g., manufacturing processes, shipping processes, etc.) have been prevalent for years. Industrial Engineers commonly used the term "Process Engineer" as opposed to "Process Owner" or "Process Manager" [Grass (1956)]. The process management approach involves:

- Documenting the process to obtain an understanding of how work flows through the process [Elaborate and paper-based "mapping" methodologies were designed for this documentation process (Mullee and Porter (1956)],
- The assignment of process ownership in order to establish managerial accountability,
- Managing the process to optimize some measures of process performance, and
- Improving the process to enhance product quality or measures of process performance.

In the late 1980s, U.S. manufacturers discovered that the new information technologies allowed managerial control of enterprise-wide process management [Davenport and Short (1990)]. Process management provided competitive advantage through cycle-time reduction, and the new information technologies provided managerial control. The constant quest for competitive advantage, enabled by new information technologies, unleashed the private sector management transformation that is still underway. Davenport and Short state that "thinking about information technology should be in terms of how it supports new or redesigned business processes, and business processes and process improvements should be considered in terms of the capabilities that information technology can provide." Davenport and Short go so far as to call this new approach to process management: *The New Industrial Engineering*.

5.1 What are Processes

One source of continual confusion is the imprecise use of terminology. *Process* is a word that means different things to different people. For example, Davenport and Short define a business process as "a set of logically related tasks to achieve a defined business outcome." It's difficult to argue with this definition, but it is not sufficiently precise for our purposes. For example, "logically related" has no temporal workflow connotations.

When we speak of processes, we precisely imply *Event-Driven Process Chains*. According to Scheer (1993), a "process is an occurrence of some duration that is started by an event and completed by an event." We present the concept with a simple example from a hypothetical manufacturing organization. The high-level functions of this organization are presented in Figure 2.

The primary function is to "Fulfill Order," which is decomposable to the second-level functions that are executed to complete order fulfillment. Of course, the second-level functions could be decomposed to lower levels as desired. Some would argue that Figure 2 represents a process. Figure 2 seems to meet the requirements of the Davenport and Short definition; i.e., it is a set of logically related tasks to achieve a defined business outcome, a fulfilled order. By our terminology, Figure 2 is a static functional decomposition; i.e., a set of hierarchically decomposed activities. Figure 3 adds the events for converting the functions in Figure 2 into a process.

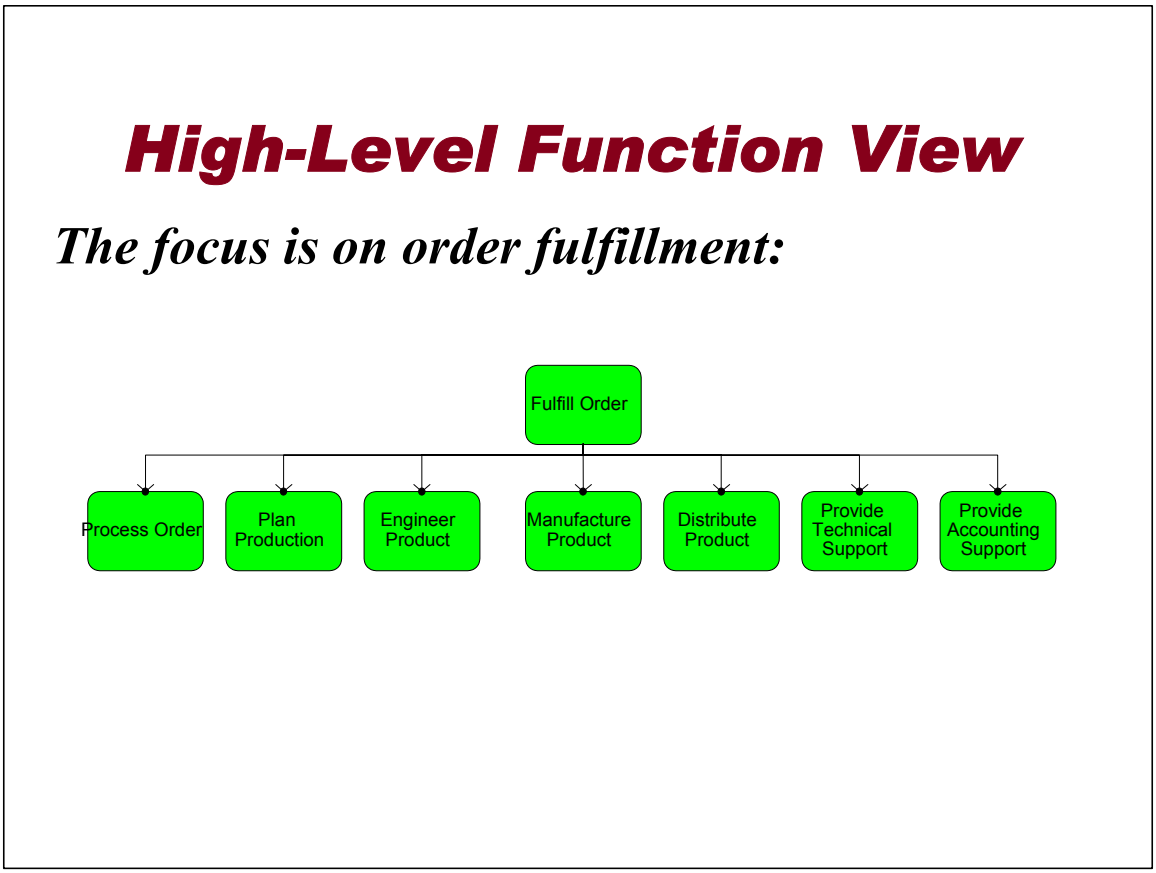

Figure 2. - High-Level Functions for an Hypothetical Organization

Figure 3 is more complex, but it is easy to understand. First, notice that the process chain in Figure 3 contains all of the second-level functions in Figure 2. These functions are linked using events. To describe events, we use a blow-up of the far left of Figure 3. This picture is provided in Figure 4.

Figure 4 includes two events and one function. The important concept in this figure is the understanding that events "trigger" functions. The order arrives, it is processed, and then a notification is submitted. The combination of events and functions describes a specific time sequencing of the functions, and the sequencing is explicitly documented. This time sequencing defines a dynamic relationship (Figure 3.) as opposed to a static relationship (Figure 2).

Now we can review Figure 3 with a better understanding of the concepts. First, as mentioned above, the process chain in Figure 3 is dynamic; i.e., there is an explicit time sequencing of the events. Second, some functions are executed simultaneously, and Boolean logic defines the relationships. Third, the process in Figure 3 is cross-functional. In fact, it spans every function in our hypothetical organization.

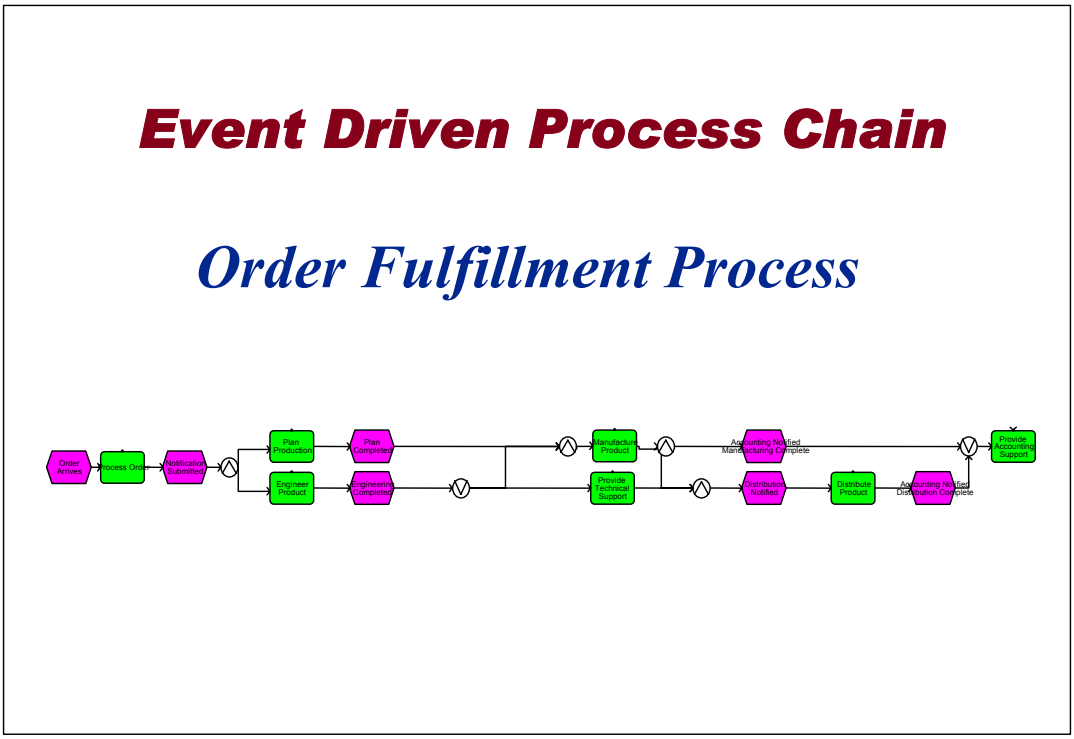

Figure 3 - Event-Driven Process Chain Diagram for the Hypothetical Organization

6. Public Sector Process Management

In the public sector, the primary benefit of process management is the "increased effectiveness and efficiency achieved from restructuring the organization along cross-functional processes." In the reengineering of The Army Plan, other benefits were noted:

- By managing processes, the DoD can better integrate warfighting perspectives and priorities with resource management (this is equivalent to the increased private sector focus on managerial accounting through activity-based management).

- Many new DoD management initiatives (e.g., the GPRA and ITMRA) require process management, and it is impossible to implement process management concepts under the old industrial-age management models.
- Process management opens the door for creative and innovative approaches to enhancing organizational performance.
- Process management allows the effective implementation of modern systems and *Standard Software* (ERP Systems); i.e., most new implementations are process-oriented?

We agree with the above, but we note some subtle differences that others have not described in detail.

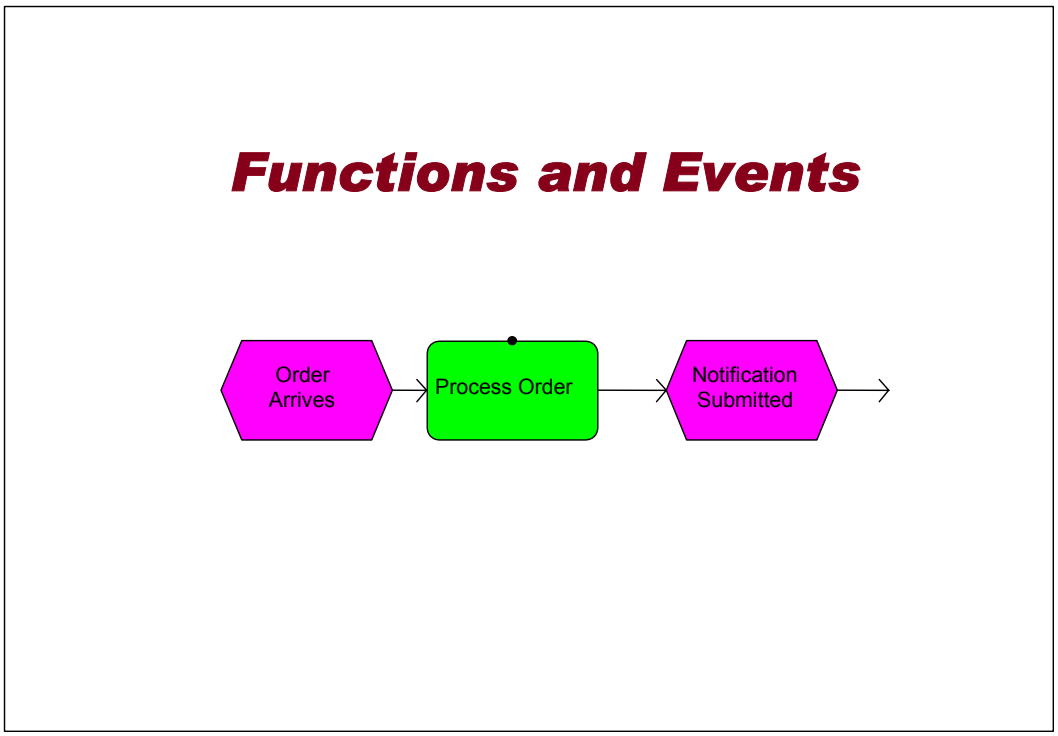

Figure 4 - The Relationship Between Functions and Events in a Processes

7. Problems in Implementing IT-Enabled Process Management in the DoD

A number of recent U.S. legislative actions have forced process management on public sector organizations. One could argue that the impacts were not completely understood at the time of the mandates, but never-the-less, public sector organizations

have a process management mandate. Some of these mandates are reviewed below, but we first offer the following general observation.

7.1 A Process Mandate Without a Process Management Structure

Managing by process is an all or nothing proposition. You can't maintain a command and control hierarchical management structure and expect process management to be effective. Likewise, you can't maintain "stovepiped" information systems and expect process management to operate efficiently and effectively. One of the problems that has hindered the DoD implementation of the Government Performance and Results Act (GPRA) and the Information Technology Management Reform Act (ITMRA) is that both call for process management concepts, without changing the management model. That is, they mandate process management concepts on a hierarchical command and control management structure. The private sector experience is that this approach enhances the probability of failure. The process-oriented mandates of several of the more important laws and executive orders are reviewed below.

The Government Performance and Results Act

The Government Performance and Results Act is the primary legislative framework through which agencies are required to set strategic goals, measure performance, and report on the degree to which goals were met. It requires each federal agency to develop strategic plans that cover a period of at least 5 years. The plan should include the agency's mission statement; identify the agency's long-term strategic goals, and describe how the agency intends to achieve those goals through its activities and through its human, capital, information, and other resources. Under the GPRA, agency

strategic plans are the starting point for agencies to set annual goals for programs and to measure the performance of the programs in achieving those goals.

The law calls for an agency strategic plan with specific goals and objectives. Furthermore, the agency is required to provide

> a description of how the goals and objectives are to be achieved, including a description of the operational processes, skills and technology, and the human, capital, information, and other resources required to meet those goals and objectives.

The focus of this section of the law is on formally linking planning objectives to organizational processes. Furthermore, the agency shall

> establish performance indicators to be used in measuring or assessing the relevant outputs, service levels, and outcomes of each program activity.

That is, performance measures will be defined that are linked to organizational functions.

The Information Technology Management Reform Act

The Information Technology Management Reform Act of 1996 (i.e., ITMRA or the Clinger-Cohen Act), which took effect August 8, 1996, abolished the Brooks Act (it repealed Section 111 of the Federal Property and Administrative Services Act of 1949 (40 U.S.C. 759)]. The Brooks Act made the General Services Administration (GSA) the central authority for procurement of automatic data processing (ADP) resources. Passage of the ITMRA is causing a major paradigm shift in the process for acquiring and managing IT. The task of understanding the objectives of ITMRA and establishing a program or process to manage IT in a Federal agency is a major undertaking.

The word “process” is used throughout the act, but here is one reference that is particularly relevant:

> In fulfilling the responsibilities under section 3506(h) of title 44, United States Code, the head of an executive agency shall-----where comparable processes and organizations in the public or private sectors exist, quantitatively benchmark agency process performance against such processes in terms of cost, speed, productivity, and quality of outputs and outcomes.

The intent is clear in this passage. It is a direct mandate to manage by process, while benchmarking against other public and private sector organizations.

Executive Order 13011 of July 16, 1996

One section of the executive order relates specifically to the duties of the Chief Information Officer (CIO) Council:

> The CIO Council shall share experiences, ideas, and promising practices, including work process redesign and the development of performance measures, to improve the management of information resources.

This extends process management to include the private sector concept of business process improvement. The terminology differences are subtle. This paper uses Harrington's (1991) definition of BPI. "BPI is a systematic methodology developed to help an organization make significant advances in the way its business processes operate. The main objective is to ensure that the organization has business processes that: eliminate errors, minimize delays, maximize the use of assets, promote understanding, are easy to use, are customer friendly, are adaptable to customers' changing needs, provide the organization with a competitive advantage, and reduce excess head count."

The law is clear in its intent. It is pushing public sector organizations in the direction of private sector process management. However, process management does not work very well when overlaid on a hierarchical command and control management structure. This has been documented in the research literature [See, for example,

Majchrzak and Wang (1996)]. Hence, the shift to process management requires a reengineering of management, which is one of Champy's (1995) major points.

The next compelling reason for moving to process management is less understood, but equally important. The business process provides the internal organizational structure for integrating information systems. Integrated systems deliver competitive advantage when they are properly aligned with the organization's value adding processes.

7.2 Properly Aligned and Integrated Information Systems

We borrow an example from the U.S. Navy to make this case, but there are many public and private sector examples. Figure 5 (taken from a Logistics Management Institute briefing) indicates a problem in providing base-level system support, while providing senior managers with the information necessary to manage installations.

This picture provides a model for providing information from a sequence of stand-alone systems to a senior or regional executive. Ignoring the technical issues, the idea is to provide the executive with a "roll-up" of information from various information systems. From the executive's point-of-view, an information query should be to a single integrated system, as opposed to a number of stand-alone systems. This is a relative standard presentation, and the executive has better access to information; that is, a query is made to a single system as opposed to searching for information from multiple systems.

Figure 5 represents a model that is suboptimal because it ignores the business processes that define the executive's management responsibilities. In modern enterprise integration implementations, it is the business process that provides the mechanism for

integrating the systems (Scheer, 1994b). That is, the business processes generate organizational outputs and executives are responsible for managing this process of output creation. The information systems should align with (i.e., integrate in accordance with) the business processes. This key concept is indicated in Figure 6.

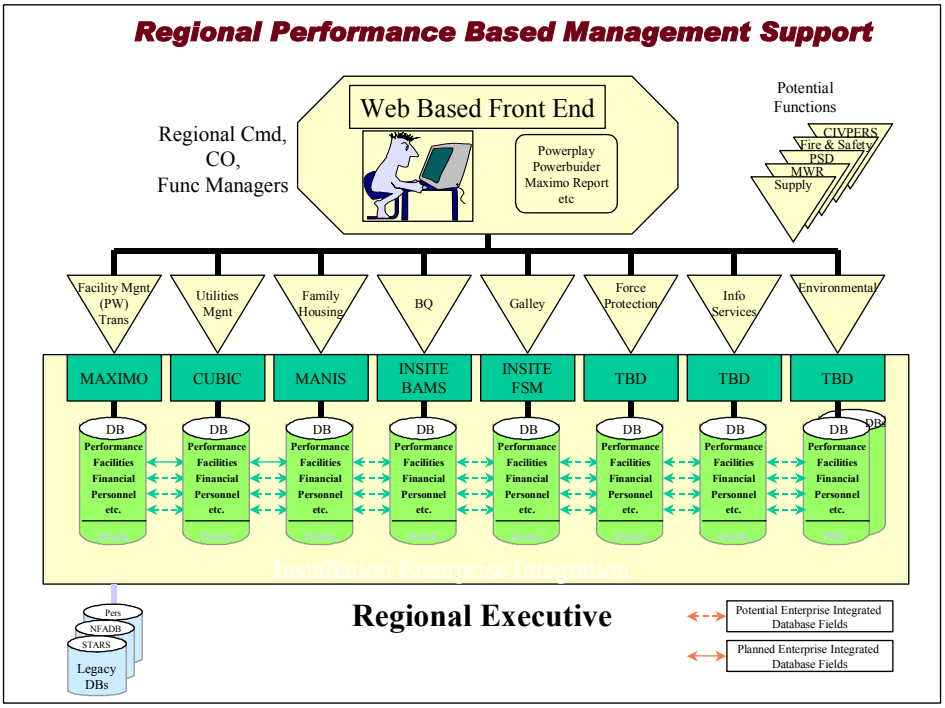

Figure 5 - Systems to Support Installation Management

The business processes deliver value to the customer. The executive's primary objective relates to the delivery of value to the customer. The integrated systems are secondary and subservient; they enable a more efficient and effective delivery of value to the customer. The organization's systems should be integrated around the business process. It is possible to integrate systems without this alignment, but there is no guarantee that these non-aligned systems add value to the customer.

7.3 The Culture of Process

Organizations that attempt process management without realigning their information systems will most likely not reap the full benefits that process management can deliver. They can't quickly respond to the customer and management does not have appropriate information, but these are only the obvious observations.

If organizations maintain their stovepiped systems while attempting process management, the information owners within the stovepipes stymie effective process management. There is tremendous pressure to revert to hierarchical management practices. However, the reverse is also true. If systems are aligned with processes, then it is much easier to maintain a process-oriented culture. That is, the stovepipe owners have less power, and it is difficult for them to sabotage the process management efforts.

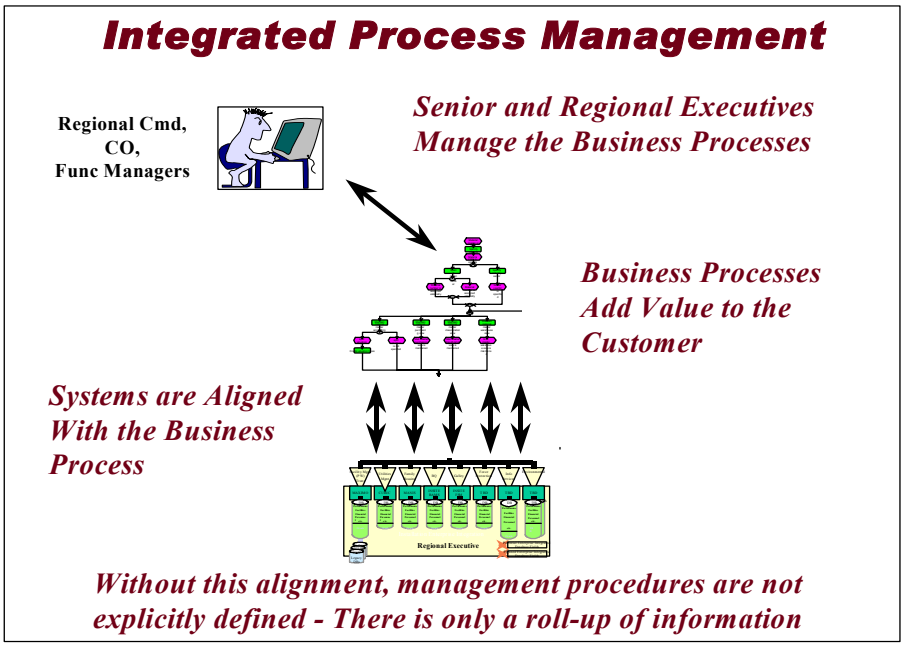

Figure 6 - Properly Aligned Process Management Model

8. A New Strategy for Implementing IT-Enabled Process Management for the DoD Enterprise

Since a large part of the DoD enterprise is comprised of business processes, we recommend a business approach to addressing the problem. The implementation approach is comprised of three steps:

- A review and streamlining of rules and regulations,
- The transition to a modern process-oriented management model that addresses the strategic, business process, and implementation levels of the organization, and
- A realignment of all information systems to support the business processes and objectives as stated in the organization's strategic plan.

While not perfected for the public sector, the approach below is a proven private sector solution for eliminating overhead and underhead, while focusing scare resources on the core of the organization. The solution also provides timely information to managers so they can manage cross-functional processes as they span organizational boundaries.

8.1 Review and Streamline Rules and Regulations

In our work for the Office of the Assistant Secretary of Defense (C^3I), we suggested a starting point for addressing DoD hierarchical management problems:

> The DoD should rely upon comparative analysis and benchmarking. The DoD might have the ambition to "leap frog" the competition, but may be content to merely emulate private sector organizations. A failure of the *Corporate Information Management* initiative was an absence of benchmarked goals. A reasonable beginning for a process innovation experiment would be:
>
> 1. A historical legal review of externally imposed rules and regulations, and
> 2. Private sector benchmarking.
>
> A common ingredient of successful business method change is a set of goals that are not only ambitious, but damn near ridiculous. This forces a zero-based approach to problem solving. [Gulledge, et al. (1995)].

While our recommendations were focused on all DoD activities, this type of review is essential for management of the business processes. Much process-oriented work is

focused on meeting the requirements of the "law." The first level of the "law" is the OSD interpretation of legislation. Interpretation and "clarification" are added at every management level, and eventually the Services add their interpretations. These regulations are "clarified" and reinterpreted at the major command level. Simple requirements often become complex at lower levels, and an impetus for creating non-value-added activity.

We have noted that many insurmountable obstacles that are caused by regulations are often self-imposed. Many hours are wasted submitting reports as end products to meet requirements that were never intended. This was true in our private sector case study work, and it is true throughout government organizations. The regulations should be holistically reviewed and streamlined, using the original legislation as a baseline.

8.2 Transition to a Modern Process-Oriented Management Model

By 1995 most large private sector companies had shifted from purely hierarchical organizational structures to those that better accommodate horizontal workflows. It was clear that a properly implemented process management model could deliver competitive advantage, and managers were trying to address the critical questions involving strategy and management practice [Garvin (1995)]. The most important lesson learned is that it was extremely difficult to implement process management in hierarchically managed organizations [Majchrzak and Wang (1996)]. A new management model is required. Having studied the process management implementation in many private sector firms, we have identified the following critical items:

- A strategic plan that contains specific objectives with time-dated targets.
- An integrated enterprise model that documents how organizational processes relate to functions, organizational units, and information flows.

- An implementation plan that aligns information systems with processes, so that managers have the proper information to manage by process.
- A change management plan that guides the transformation from functional to process management.
- A resource plan that can be linked to requirements, and sufficient resources to complete the implementation.

This section addresses the first two items, and the third is addressed in the following section. The change management plan is not the subject of this paper, but we note that it is a critical item for success, and we adhere to the eight critical steps for success as presented by Kotter (1995). Without such a plan, the transformation effort is likely to fail.

8.3 The Vertically and Horizontally Integrated Process Management Model

8.3.1 Vertical Integration

Process management requires that senior management activities be focused on core processes as opposed to function. The primary agreement among managers about future courses of action is the strategic plan. The structure of a plan varies, but in general it contains a future vision, a mission, a set of strategic goals, strategies for achieving the goals, specific objectives, and performance measures. Since business processes cross functional boundaries, process ownership is an issue; i.e., these boundaries transcend the organizational chart to include political and budgetary boundaries. Objectives define specific targets for function performance. Functions are embedded in cross-functional processes; hence the objectives in the plan must be formally linked to functions. This linkage is indicated in the two upper levels of Figure 7.

The links may seem trivial, but they are not. Complexity arises because there are many nested plans, each with a set of objectives. Without proper documentation, it is

difficult to establish managerial accountability. The complex nesting of plans is demonstrated in Figure 8, using a decomposition of DoD Installation Management plans.

8.3.2 Core Process Management

"A core business process, as distinct from other processes, is a set of linked activities (i.e., functions) that both crosses functional boundaries and, when carried out in concert, addresses the needs and expectations of the marketplace and drives the organization's capabilities" (Johansson, et al., p. 16).

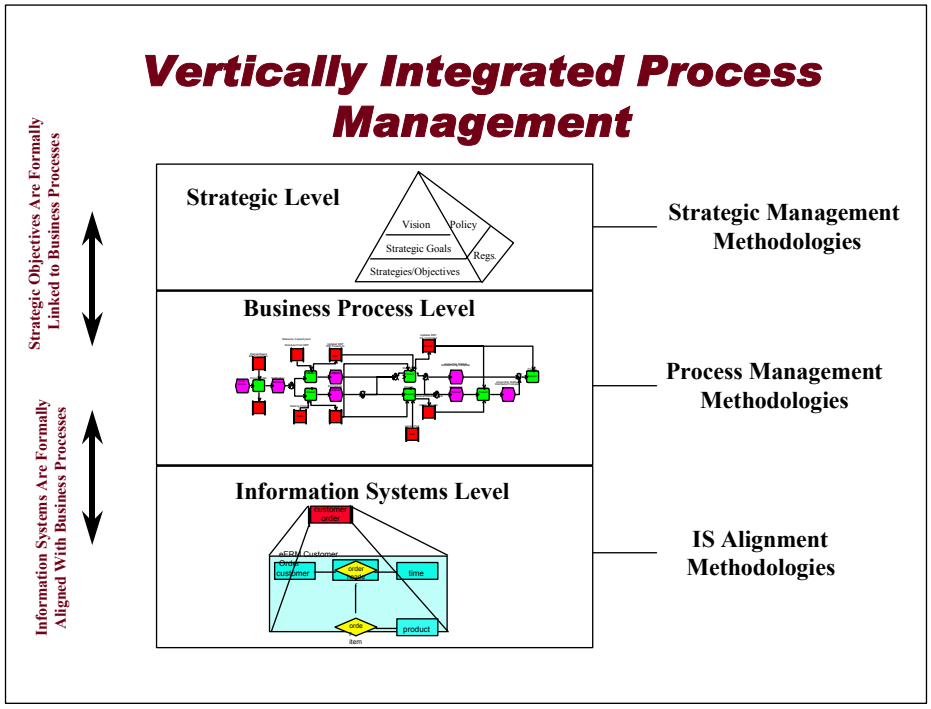

Figure 7 - Vertically Linked Process Management Model

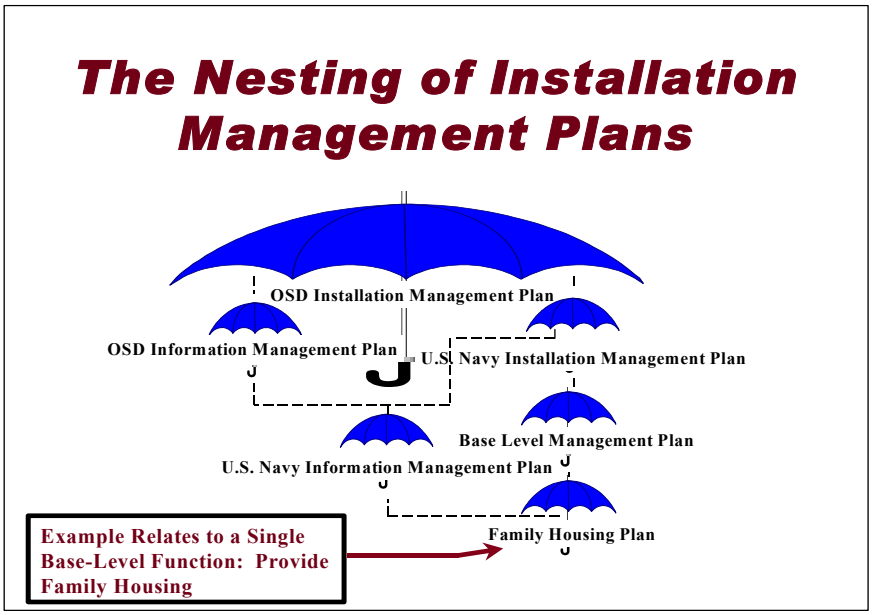

Figure 8 - Example of the Nesting of Plans

Most DoD functions have been defined at the highest level. This was accomplished in the development and publication of the *Department of Defense Enterprise Model*. With respect to DoD business functions, the functions need to be linked (via events) to define the processes. Some of these processes will be core, and others will be support. After process engineering, the objectives in the plans should be formally linked to the processes. An example of the linkage is presented in Figure 9.

Figure 9 describes several fundamental process management concepts. First, plans must contain quantifiable objectives, and these objectives are formally linked to processes. The link to processes is accomplished by identifying the functions within the processes that are impacted by a particular objective. This linkage is essential, or one cannot establish accountability nor performance measures. If a function does not map to any objective, then that function is a prime candidate for elimination or outsourcing.

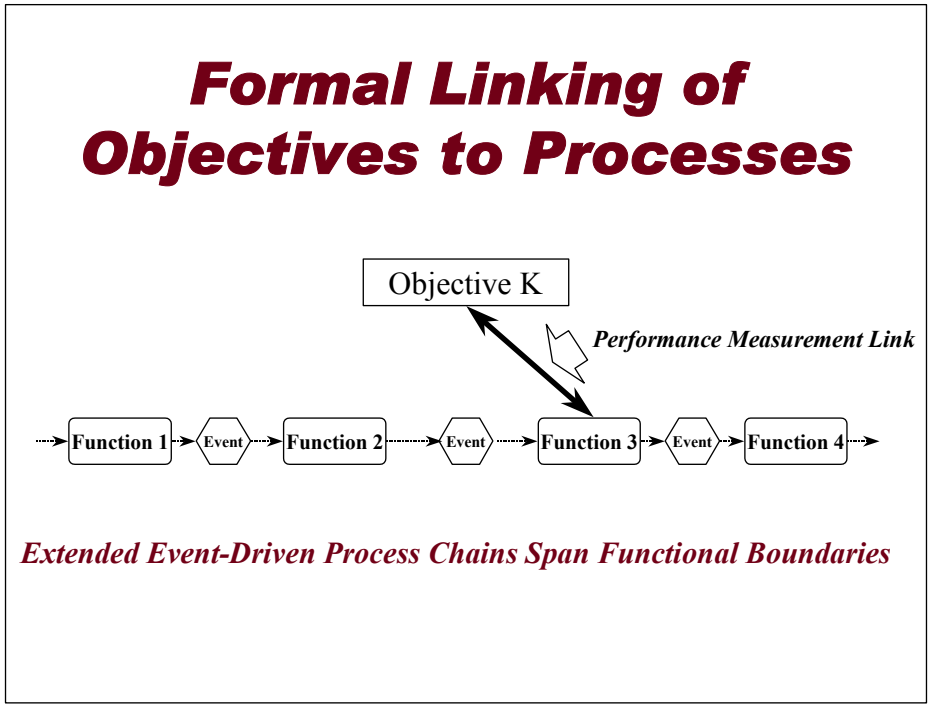

Figure 9 - Linking Plans to Processes

Figures 7-9 capture the basic high-level concepts of process management by linking of planning objectives to core processes. Of course, the mapping is much more complex, because functions are decomposable. An automated documentation tool is required, if for no other reason than configuration management.

8.3.3 Horizontal Integration

Unfortunately cross-functional enterprise management is more complex than organizing to manage by process. The extended event-driven process chain provides one "view" of a complex organization. Managers must be provided with appropriate process information, or it is difficult to manage by process. The nature of the problem is apparent from Figure 10. We use the Installation Management example to demonstrate the point.

The various Installation Management functions are currently supported by stand-alone information systems. These information systems provide support to specific

domains, such as “Utilities Management” or “Family Housing” in Figure 10. The “Utilities Management” system is neither integrated nor interoperable with the “Family Housing” and “Environmental Management” systems. Efficient and effective management of the “Installation Management” core process requires that a single system support the cross-functional process. Otherwise, process management is difficult if not impossible. Private sector organizations understand this premise clearly - In order to manage by process, the organization’s information systems must be aligned with the process. The aligned situation is presented in Figure 11.

This critical point about process management was uncovered in our interviews with Eastman Chemical Company, where we encountered precisely this problem. After reorganizing the corporation with a focus on process and extensive process engineering, the company realized that it could not reap the full benefits of the change without implementing a new information system that supports the newly engineered processes. After a two-year effort, the integrating system was implemented. This was confirmed in conversations with Mr. Robert Savell of Eastman Chemical in May of 1996. Since the popular press has identified several hundred of these large-scale implementations that are currently underway in the U.S., we don’t believe that the Eastman experience is that unusual.

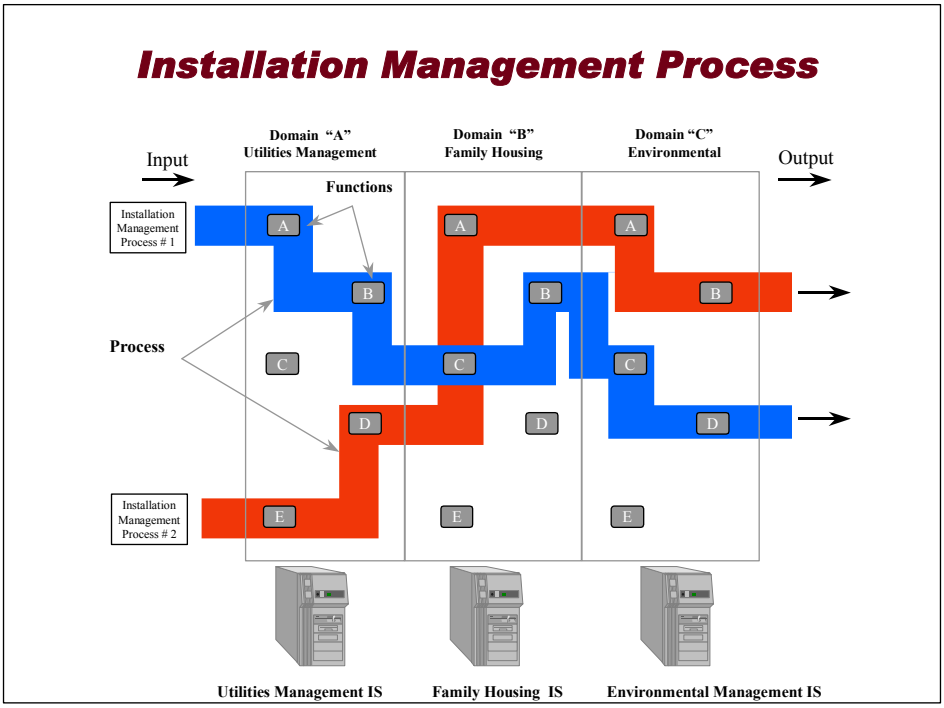

Figure 10 - Process Management With Stovepipe Systems

The single information system provides the public sector manager with complete information about the process through a single query to the process-aligned system. The concept is simple, but the implementation can be quite complex. The next section discusses two ways that have been used in the private sector to achieve process-alignment of information systems, while maintaining and productively using legacy systems.

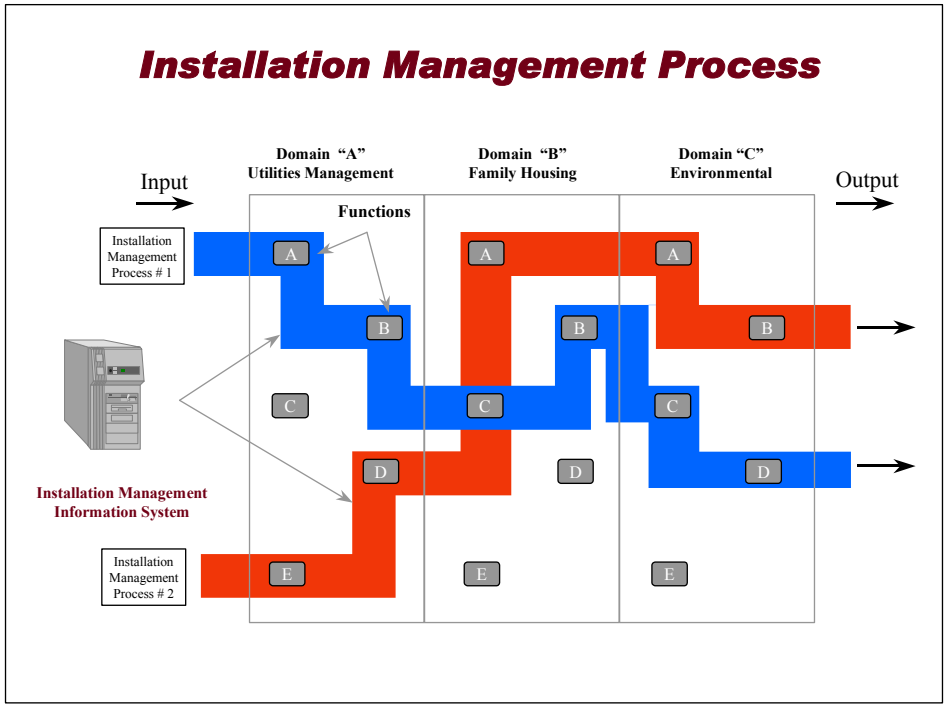

Figure 11 - Installation Management With Process Aligned Information Systems

8.3.4 Information System Realignment

The alignment of information systems with cross-functional processes in order to meet strategic organizational objectives has been a major topic in the literature in recent years. The design and implementation of a new system will provide alignment, but this is typically infeasible. It is too risky and costly. Two approaches to achieving alignment are discussed in the following sections.

Brokered Systems (Integration Without A Process Focus)

Consider the model in Figure 12, which is receiving considerable attention in private sector organizations.

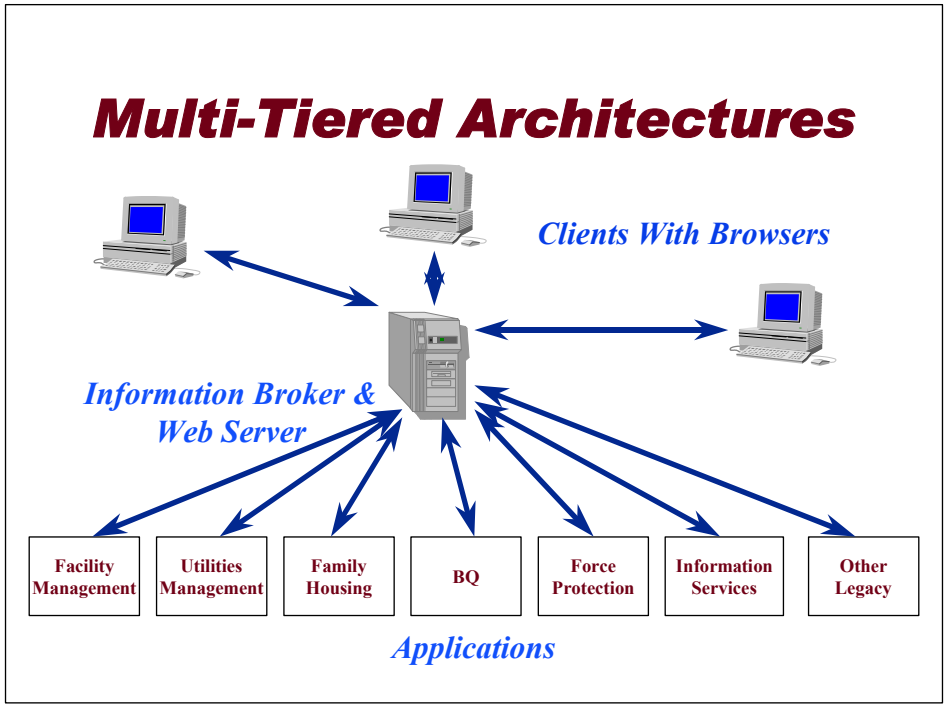

Figure 12 - An Information Broker Approach to Legacy System Alignment

The approach in Figure 12 avoids data standardization paralysis by mapping data elements through a separate tier that is called a broker. The logic is simple. Since data standardization is difficult to achieve, direct legacy system alignment is difficult to implement. The "broker" draws information from the legacy systems, maps data elements, and distributes information to the users. From the user's point of view, the interaction is with a single system that provides information about all functions. If this approach is implemented through a Web server and client browsers, it is the familiar client-server model of the World Wide Web. Those with experience in implementing these types of architectural models will attest to the fact that the implementation can be complicated. An integrated enterprise model is essential, and legacy wrapping [see Winsberg (1995) and Aronica and Rimel (1996)] may be required.

Standard Software Solutions Through Reference Models (ERP Systems)

This approach has proven successful in the private sector, and in our opinion, should be considered by the DoD. As previous mentioned, proprietary development and implementation of integrated systems is costly and risky. The radical approach of Hammer and Champy (1993) proved to be very difficult and costly to implement in organizations. Reengineering was difficult, but the investment costs for new systems and technologies to support the reengineered processes were often staggering. By the mid-1990s, the approach taken by most private sector organizations to reengineering was to purchase preengineered and integrated software products called *Standard Software Solutions*. The generic term for *Standard Software Solutions* used in industry circles is Enterprise Resource Planning (ERP) Systems. The world's largest supplier of *Standard Software Solutions* is SAP, AG, and a detailed examination of SAP's R/3 client/server *Standard Software Solution* may be found in Buck-Emden and Galimow (1996) or Bancroft (1996). Keller and Teufel (1998) discuss the process-oriented implementation issues of R/3.

In some sense, the implementation of a *Standard Software Solution* is the antithesis of reengineering. The software is implemented, and the implementing firm alters (i.e., engineers) its processes and dataflows to agree with the *reference* process and dataflows that define the *Standard Software*. That is, the first rule of reengineering is: Focus first on process, and then search for enabling technologies. The implementation of a *Standard Software Solution* requires the opposite. The processes implied by the software are implemented, and the firm's processes are altered to agree with the software.

This approach, which uses reference process, data, and function models, is appropriate for generic business processes. For example, every company has a slightly different procurement process, but basically they all do the same thing. Hence, if the reference model implied by the *Standard Software* meets 80% of required functionality, it is more cost-effective to alter internal processes to agree with the reference model than to design, develop, and implement a proprietary system that meets 100% of required functionality. Hence, one can see that reference models are not appropriate for many types of processes. From the perspective of the provider of *Standard Software Solutions*, they are only appropriate for processes that occur in many organizations. The strategy of the provider is to build it once, and sell it many times.

Public Sector Example

Since every defense installation has similar processes, installation management would seem of be a good candidate for reference model implementation. The management of facilities is slightly different at every installation, but there is significant overlap in required functionality. It is probably more cost-effective for the DoD to achieve information system alignment through the development and implementation of DoD-wide reference models, as opposed to service- or agency-specific proprietary solutions. These concepts are explained using Figure 13.

Figure 13 shows how the reference model would be applied. The lower level of the figure indicates the basic reference model. This model integrates all common installation management functions. It is based on the concept of a generic base. Since all bases are not the same, there will be installation specific modules. For example, there may be inherent differences in Air Force versus Navy installations. Finally, there may be

specific tailoring at the installation level. The top level of Figure 13 indicates this. The idea is simple: If the reference model captures 80% of the required functionality, then there you can save many hours of "reinventing the wheel" by developing and implementing different system configurations across bases.

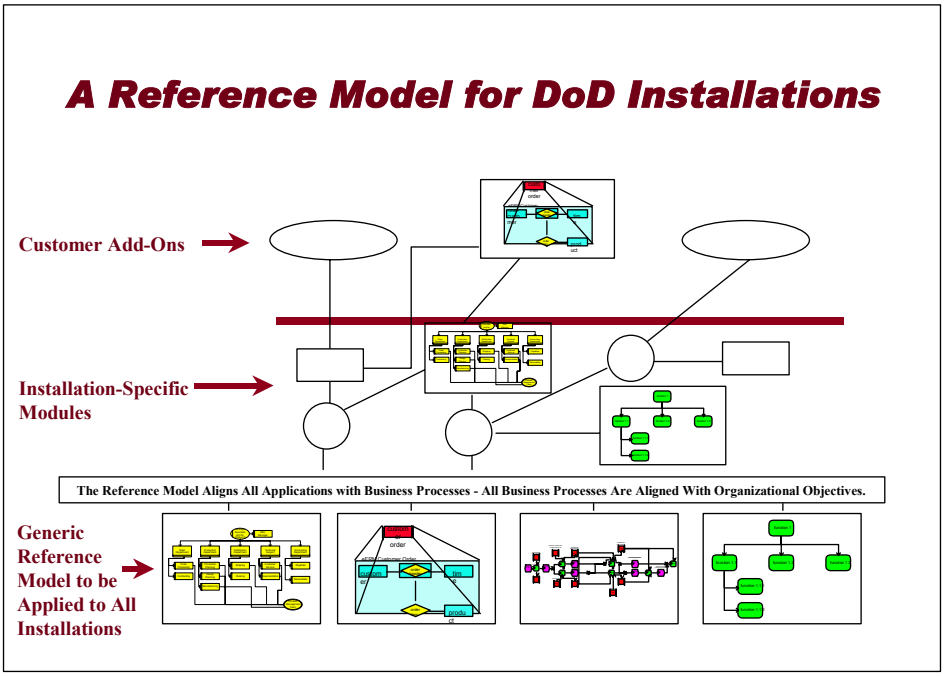

Figure 13 - Reference Models for Installation Management

The large gains from reference models come from the reuse of data models; i.e., it takes much more time and effort to develop data models than function or process models. Reference data models are defined by Hars (1994) as a general industry-oriented conceptual data model. Specifically, the models represent a generic description of an organization's generally applicable structures (such as *order processing*, *bill of materials*) that are typical for a specific industry. Information on an organization's data knowledge is stored in module libraries that are then used as building blocks for efficient databases.

Reference models offer the organization a means of storing and controlling data through the use of rigorous standards, which reduce erroneous data, inconsistent, terms and provide a consistent semantic structure. Furthermore, data models can be used to identify areas of organizational improvement because the analysis required to generate the model will often show deficiencies in related business processes.

Of course, the reference models must be developed, and the associated *Standard Software* must be developed once, and then implemented at every DoD location with similar processes. The savings are obvious, and the DoD should consider methodologies that have been used to successfully develop large private sector reference models.

Developing Reference Models for the DoD

For reference model development we describe a methodology called the Architecture of Integrated Information Systems (ARIS) (Scheer, 1999a and 1999b). This methodology can be used to define the requirements for reference models for any of the major standard software solution vendors, and it was originally used to develop the SAP reference models. The methodology is supported by an automated toolset that automates the DoD *Technical Architecture Framework for Information Management* (TAFIM) (US Department of Defense, 1996), and its replacement, the C4I/SR Architectural Framework (US Department of Defense, 1997). It also supports process-oriented implementations from reference models (Scheer, 1994b).

Most modern information system planning approaches argue for decomposing the organization into "views." Some views are in the domain of managers (for example, organization and function) and others are in the domain of technologists (for example, data). These views are modeled separately, and then reassembled (that is, integrated) to

form an integrated model of the organization. This documented set of organizational views is called an integrated enterprise model. Scheer (1999a, 1999b) accomplishes the modeling objective by considering multiple views:

- *Organizational view* - represents the user and/or organizational units which exist to perform work within an organization,
- *Functional view* - represents functions that are performed (and their relationships) along with a detailed description of the total function hierarchy,
- *Data view* - represents the conditions and events that exist when data is updated with a data processing environment, and
- *Process/control view* - represents the relationships that exist between the views and the synchronization of their combined information flows.

Other methodologies advocate slightly different views, but the concepts are the same.

We omit the details of the reference model development for this concept paper, but we offer the following suggestion for how the reference model would align existing installation information systems with the newly defined and documented business processes. Figure 14 is used to aid the discussion.

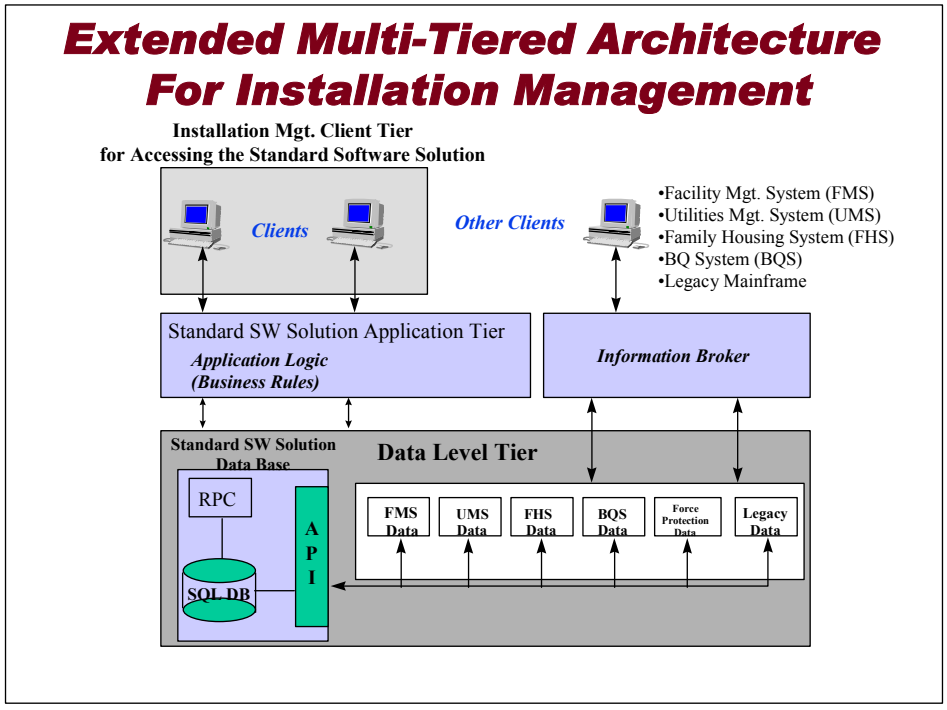

Figure 14 - Installation Management Enterprise Architecture

Figure 14 represents an approach that private sector organizations have used to integrate legacy applications with standard software solutions. The figure is a generalization and combination of Figures 12 and 13. Users query the system through the standard software solution. These users are the upper-left clients in Figure 14. If the users need information from the various stand-alone systems (lower right section of Figure 14.), the transfer occurs through proprietary APIs at the database (or application) level.

There may be intense users (i.e., data creators) for the stand-alone systems. These users require direct access to the standalone systems, as indicated in the upper right section of Figure 14. Direct access is required for performance reasons, and the access is directly through the broker as indicated in Figure 12. The private sector analogy might involve linking the organization's ERP system (i.e., the *Standard Software Solution*) to the Product Data Management System, the Enterprise Document Management System, the Procurement Execution System, etc. The power users of the Product Data Management system, for example, would require direct access to that system.

8.4 Developing and Implementing Reference Models for the Public Enterprise

This section contains a discussion of all tasks that must be completed in order to plan for implementation, develop the reference model, and monitor contractor performance in the implementation of the integrated system. The strong recommendation to the DoD is to define the requirements using contractors who have experience in requirements definition-level modeling for enterprise integration. Then, the project should be completed by a company or companies that have actually designed and built reference models for large private sector implementations; e.g., SAP, Baan, Oracle, etc.

The following steps provide a rough outline of how the effort should proceed. It follows many of the ideas that were introduced by Kirchmer (1998).

- Begin the following items simultaneously:
    - Assemble all strategic plans, and
    - Review all existing rules and regulations, using the original legislation as a baseline.

- Develop the high-level function and organizational views (Use the C4I/SR Architectural Framework as a guide).
- Integrate the function and organization views around core processes.
- Link the objectives in the strategic plans to the functions that are embedded in the core processes, and document using objective diagrams, a modeling methodology that is included in the ARIS Toolset.
- At this point, the highest process management level is completed, as are three views of the integrated enterprise model.
- Request permission to continue under new rules of process ownership.
- Reconcile regulatory review with enterprise model and suggest changes in regulations.
- Develop data view at the cluster level and run gap analysis.
- Generate requirements for the standard software solution reference model.
- Develop architecture for integrating existing legacy applications.
- Write SOW to be targeted to a contractor who has actually developed standard software solution reference models.
- Evaluate proposals and ensure that the contractor captures all requirements in the development plan.
- Monitor development of the reference models.
- Develop a second RFP for a contractor to implement the reference models (these contractors could be any of the usual implementers; for example, Cap Gemini, Deloitte and Touche, Price Waterhouse - Coopers and Lybrand, Bull, etc.
- Monitor the implementation, using implementation performance measures and management practices that have been used by large private enterprises that have implemented reference models in their organizations.
- Evaluate the implementation and plan for the implementation of the reference models at other DoD organizations.

9. Conclusions

This paper focuses on new ways of managing public enterprises. New methods are essential for a number of reasons. The primary reason is that in the absence of new methods, it is unlikely that our leaders will be able to reduce infrastructure while

increasing effectiveness. There seems to be general agreement that a tweaking of the old model is not appropriate, since it is unlikely to deliver the desired results. This paper argues for the implementation of private sector methods that have been successfully implemented in most large western corporations.

We argue that there is nothing special about public sector business processes that insulate them from modern private sector management methods. The model that is proposed is integrated and information technology-enabled process management. The paper suggests a combination of a process management model with private sector process-aligned standard software solutions. This approach has been effectively used by most of the largest US corporations.

Process management has received much attention in the private sector management literature, and its benefits are well known. Much less has been written in the public sector management literature, and what has been written has been focused on specific techniques for example, Total Quality Management. This paper discusses the benefits of public sector process management, and focuses in some detail on two of the reasons that public organizations have incentive to move to process management.

The first reason relates to the public law. The law mandates process management approaches on public organizations. However, the mandate to date has been implemented in the traditional command and control organizational structures that are holdovers from the industrial age. These mandated process management concepts are not like to be effective when implemented in these organizational structures.

The second reason relates to the interaction between organizational processes and the new information technologies. Integrated information systems are desirable, but they

are effective when they enable the organization's value adding processes. The business process forms the basis for integration, with the organization's system integrated in such away that they are aligned with the process. Process-aligned information system help to create a culture that enables process management.

We provide sufficient detail to define a high-level plan for a project to transition a public organization to the process-aligned enterprise. We explain modern private sector approaches for achieving enterprise integration, including both vertical and horizontal integration. We also show how the technology model aligns with the management model, and discuss the implications for implementing such a model in an example, using the DoD Installation Management enterprise. Finally, we outline the steps for implementing a project, following standard private sector implementation practices, within a particular public enterprise.

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